Finding a Pathway for Sustainable Water and Wastewater Services

By Steve Allbee

Meeting public health and environmental objectives is not about investing in the water assets once and being done with it. The assets must continue to productively exist in the indefinite future, just as the services that are delivered with these assets will continue to be needed.

The vision, policy and financial commitment demand a continuous and sustainable upgrade and reinvestment strategy. A successful pathway forward requires that service providers organize and manage in the context of sound institutional structures, observance to economic principles, and judicious adherence to business-like practices. Asset management is a vital business-oriented linchpin in bringing about a culture of sustainability in water services.

To protect the gains in water quality of the last 30 years, the most significant upcoming challenge is to efficiently and effectively manage an aging system. The vision, strategy, programs and partnerships that led to past achievements will fail to yield a reliable future. The absence of a strategic shift in the service paradigm jeopardizes the financial solvency of many systems and leaves the environment, public health and financial stability at risk.

An approximate doubling of expenditures is foreseeable. Ratepayers and local taxpayer revenues will be called upon to finance the work. The water sector as a whole must come to recognize:

• A common understanding among federal, state and local governments about priority objectives for going forward would increase the prospects for the public's acceptance of what is required, and in so doing increase the public's willingness to pay fees that more closely resemble the full cost of services.

• Furthermore, adequate financial resources can only materialize if those called upon to pay the costs are confident that the benefits are documented, the costs are reasonable and necessary, and that the work is accomplished using the most efficient and effective practices.

Obviously, significant aspects of achieving a sustainable position are questions to be resolved in the context of the body politic. However, applying appropriate asset management practices is primarily within the domain of industry practitioners. The "how to" knowledge is our responsibility.

How Did The Current Situation Come About?

The origins of future challenges are found in the nation's process of urbanization. To meet public health and environmental concerns in urbanizing areas, governments replaced the shallow wells, outhouses and privies with central systems. As the population shift accelerated toward suburbia, water and sewer services followed. Over time, citizens came to view these services as essential and available regardless of where they lived.

During this era of spreading out, the multiple urban infrastructure investments (roads, water, sewers, schools, etc) have not been approached strategically in an interlocking manner. Yet investments in one area virtually preordained that the provision of other urban infrastructure would come next. As a whole, these urban infrastructure systems have huge economic and growth-enabling consequences. The resulting growth necessitates a subsequent upgrade in the service levels. Higher performance requirements compel that the water assets — networks, pumping stations and plants — become more sophisticated and therefore, more expensive. The human resources considered necessary to do the work demand enhanced technical and managerial expertise. The cycle continues to repeat itself.

By definition, water assets will deteriorate and eventually fail, as is the case with all assets, unless they are maintained, renewed and replaced. The long-term economic impacts of the systems and the encumbered revenues required for maintenance, repair, renewal and replacement, which are intrinsic aspects of physical assets, have not been well understood. For the most part, coming to terms with the legacy costs has not occurred. There is no grand scheme minimizing the long-term public costs of achieving the shared public health, environmental and economic outcomes. Even though the sufficiency of these assets is critical for sustaining services, they are often taken for granted, putting system performance at risk by inadequate attention, deferral or just not knowing the situation.

Although we are now challenged by this legacy, the water infrastructure paid impressive dividends. In the 1970s, many rivers and beaches were little more than open sewers. Today, many rivers, lakes and coasts are centers of healthy communities. The substantial progress of recent decades resulted from a combination of requirements and incentives.

The federal governmental assistance was a substantial factor in the early years of the major extension and upgrade of systems. Nevertheless, the widespread understanding of the Construction Grants Program, the State Revolving Fund Program and a series of programs for economically disadvantaged communities was that they would serve as a catalyst to bring systems into initial compliance. Government officials viewed the subsidies as transitional.

After the initial capital infusion, the reasoning went that the systems would gain a solid financial footing, at which point fees and associated local financial instruments would be sufficient to cover the full cost. Strategically, the pathway forward has always envisioned a point where the services would become an economically self-sufficient undertaking. For the last decade, the major thrust of the nascent policy dialogue has been stuck on the relative mix of federal, state and local fiscal responsibility.

From almost any viewpoint, the period ahead will be more demanding than what America has experienced to date. To gain a better understanding of the quantitative aspects of the water infrastructure challenge, the U.S. Environmental Protection Agency (EPA) conducted a study, the Clean Water and Drinking Water Infrastructure Gap Analysis. Rather than repeating findings and details of the report, it can be viewed online: *http://www.epa.gov/owm/gapreport.pdf*.

Sustainability and the Service Paradigm

The most strategic and important aspect of a sustainable strategy is in setting service levels and bringing best practice to bear in pursuit of the least life-cycle cost approaches to organize and manage the work. A service paradigm addresses the policy, institutional, strategic, financial and tactical aspects of how services are accomplished. Reshaping the focus of the dialogue toward a comprehensive understanding of the Achilles' heel (the economic structure) in the current service paradigm would bring clarity to the strategic and institutional options, and offer a compelling rationale for instituting change when needed.

The economic structure of the current framework is the weak spot. All of the recent assessments suggest that few, if any, of the core monetary principles of sustainable environmental infrastructure are being achieved. The current strategy appears to not produce the most efficient and effective utilization of capital and non-capital spending, and it fails to bring forward adequate resources to repair, renew and replace the existing systems and extend and upgrade services. Furthermore, the trends suggest that there is a growing subset of households where affordability of the service levels may impede achieving public health, environmental and service objectives.

Nurturing an Ethic of Sustainability

There is a growing belief that the foundation for progress in water and wastewater services may be found in the transition to an asset centric industry. Asset management as a structured body of practices first entered the U.S. state and local government arena in the transportation sector in the late '60s and early '70s. The practice included systematic inventory, condition assessment, service level determination and optimized renewal techniques. Practices of similar character are found in several private capital intensive sectors, such as oil and gas and in the power industry. There already exists a vast array of water assets. The existing assets will deteriorate. Replacing an asset too early is wasting money; while replacing an asset too late is also wasting money. The dominant upcoming challenge is to efficiently and effectively manage the optimized renewal of the systems.

Asset management focuses on risk-consequence consideration of service reliability and the life cycle cost-effectiveness in providing a satisfactory level of customer service for the long term. Best practices in asset management are systematic applications of business-like decision rules and processes under a well thought out and deliberate strategy for achieving outcomes. Awareness of best and appropriate practices is growing fast. However, the transition is still in its early stages considering the wide range of communities involved in delivering services.

Lately, the practice of asset management in the water sector has been getting a lot of attention. Of course, service providers have been building, operating and managing assets for generations, but as is the case in several other sectors, advances in systems monitoring capabilities, information handling and the maturing of decision support systems has enabled new thinking about how the work is best accomplish. The impact of the advancements in information management technologies on work processes and practices parallels a multitude of other industries.

The most recent interest is in gathering more knowledge on the "how to" aspects of bringing these new tools and techniques into practice. The typical way to gain appreciation for the value of the advanced approaches is to work through, in a simplified step-by-step manner, ways to deploy new approaches. The techniques are modeled and piloted on portions of the systems and then practitioners begin to gain further insight. In its more developed form, asset management is about making better-informed choices and gaining confidence that the most optimal infrastructure decisions are being selected and that these choices manifest themselves at optimal points in time. The basic idea is to become really good at doing the right work, at the right time, in the right way.

The asset management processes are especially adept at guiding decisions as to the effective mix of maintenance, repair, renewal or replacement of components within the systems. It is challenging to adequately consider the full range of options in the same decision matrix, since the alternative strategies produce different response schemes that have dissimilar economic timeframes where the benefits are accrued over different periods. An effective decision process can be a complicated undertaking requiring a combination of a rigorous analytic process and high-quality information.

However, a rigorous process isn't always necessary or appropriate. Knowing when a more rigorous process and higher quality data is warranted requires significant experience and understanding. The work of asset management very much encompasses the work of the utility. The effort to improve service and control costs is an integral part of a utility's organizational culture. These new approaches must be applied broadly to the hundreds of decisions made within a utility every day. The new techniques must become second nature to the thousands upon thousands of people who labor in the trenches of the water and wastewater profession. Being really good demands bringing this new thinking and problem-solving to the decision-making process on an hour-by-hour basis. In many cases, it requires a change in the culture of how the business is managed.

GASB 34 and Asset Management

There are companion changes occurring in state and local financial accounting practices that are likely to buttress this transition toward asset management. In 1999, the Government Accounting Standards Board (GASB) adopted a new accounting principle that required the valuation, depreciation and reporting of all assets, including infrastructure (Statement 34).

Until adoption of the GASB 34, reporting the book value and depreciation of infrastructure had been limited to "enterprise" funds. No systematic reporting of the "state of stewardship" for the physical assets owned by general government had ever been required.

Over time, these new accounting requirements will lead to disclosing to policy-makers and to stakeholders both the value of assets and their rate of consumption. Eventually, the disclosure is bound to increase the attention paid to infrastructure at the public policy, strategic and tactical levels.

Improved disclosure of the state of the assets will lead to a highly politicized discourse in many communities, making the continuous "deferment" of asset maintenance and reinvestment more difficult. This will be a good thing to bring about needed changes. When an election can be lost because of inadequate attention to the community's assets, which is a reflection of the community's wealth, decisions about critical assets will be more rigorously considered. Such disclosures will likely push managers to adopt much more advanced practices. The political leadership and customers will expect higher degrees of asset management excellence demonstrated by the system managers. Overall, GASB 34 provides further impetus toward advancing asset management, more quickly.

When Are Asset Management Practices Within Acceptable Norms?

Some water and wastewater organizations manage their assets well. These utilities know the condition of their assets and are aware of the long-term fiscal requirements of sustaining their systems. However, it's common for systems to not have an adequate understanding of their assets. Far too many organizations fail to commit the resources that they need to gather the information essential to making critical choices. The data that is available is often incomplete. The quality of the decisions reflects professional judgment and experience, but guesswork and chance too often influence key choices. Applying advanced practices lowers the risk of making major mistakes.

There is no particular law or regulation that directs an entity to manage its assets against a precise standard. In the end analysis, those who own and operate the assets are the point of responsibility for the stewardship of the assets. The service providers are ultimately the ones held accountable for failure to meet expectations. Although, experts encourage the adoption of modern, more advanced practices, going forward is a decision that falls on those who own the systems.

There are a growing number of service providers that are aware of the extensive body of knowledge on asset management as it applies to the water sector. The practice has a fairly wide-ranging history of being implemented in many countries and the framework tends to have considerable international consistency. In the United Kingdom, Australia and New Zealand, where asset management practices have developed, the practices are regulated in some logical context. There are new knowledge-based systems, such as the Asset Management Program Learning Environment (AMPLE), coming online as a Web-based, distance-learning enterprise. This distance-learning opportunity offers more people the prospect of gaining more sophisticated knowledge and in-depth understanding of the practices.

Admittedly, without a respected definition or clarity regarding expectations of the process, there is ambiguity as to what represents an adequate approach. The ambiguity leaves open the potential for asset management to mean anything that is so claimed. In general, those critical of a rules-based strategy question the effectiveness of national rule-based approaches in providing instruction on the implementation of best practice activities. Advocates for a rules-based approach argue that a strategy based on a decentralized policy results in a significant mismatch of requirements popping up across the country, as these types of requirements are advanced on a case-by-case basis as elements of the specifications in newly issued permits, or as a result of enforcement actions and consent degrees, or through financial instruments. The decentralized outcome is currently taking hold.

As is often the case, there is some level of correctness found in both views. Directives that are too instructive on the specifics of the process have the potential to over-shoot or dumb-down the requisite character of the asset management process. Using an archetypal regulatory template to set the tone of the relationship, establish priorities and communicate direction could well slow the adoption of asset management. If a requirement takes the form of a financial instrument, this introduces an additional set of challenges. Asset management is associated with the management of the whole system. The financial transactions where federal or state parties are likely to interact with utilities are in the context of a single project within the system. Recognize, however, that external of the federal government, the municipal bond market has started to take asset management practices into quality consideration in determining credit levels.

Probably the most salient perception that comes into play is that service providers doubt the ability of federal and state agencies to consistently oversee a mandatory asset management requirement. This leaves the water sector living with ambiguity or finding alternative ways to bring about a common understanding of the practices. One alternative is for "professionally established norms" to come though the structure and framework of a non-governmental professionally centered entity. The role

of the independent entity would be to establish and communicate a universally respected code of practice or guidelines.

No such entity exists, but there are models that serve similar purposes that could guide the thinking on the structure and character. One approach might be something akin to how appropriate practice is established in the financial industry, where the role is undertaken by GASB. Financial records are maintained according to standard accounting conventions called "generally accepted accounting principles." These principles govern how and when financial transactions are recorded and how they are reported in financial statements. The practices and procedures are defined and the profession adheres to these conventions.

The GASB model provides a proven approach to developing common understandings, practices and processes, and definitions. Alternatively, such an undertaking might be embodied or orchestrated by a sector steering committee such as the newly formed National Asset Management Steering Committee. Under either model, to be effective, these approaches must carry credibility and stature. The credibility and statue of a GASB-like entity or a broadly supported steering committee can only be demonstrated by the voluntary universal acceptance of the conventions or code of practice.

Assuming that one or a combination of both models will come about, the ultimate demonstration of value would be if adherence to this code of practice provided legally defensible coverage to the manager of a system when system failures and questions of compliance come into play. Should such a convention evolve, then federal and State governmental entities would have options. They could reflect or refer to the adherence to these accepted conventions in the context of how they carry out their responsibilities and obligations. Under any scenario, within a reasonable timeframe, these collaborative-based alternatives need to produce a greater commitment to best and appropriate practices or eventually compulsory avenues undoubted will come into play.

When Will Results Materialize?

In the past couple of years, much has been done to bring about greater collaboration focused on asset management practices. This is a journey of a decade or more. Only the "leading edge" has embedded a substantial asset management framework. Perhaps a dozen or so jurisdictions have actually produced Asset Management Plans along the lines of the framework put forth in this article. But, several hundred service providers have some form of an asset management improvement program under way. The dialogue has quickly evolved from "why you ought to do it" to concentrating on defining best and appropriate practice.

Given the bottom-up nature of the work, the most effective approach to educate practitioners about sustainable systems is to ask innovative practitioners to share their knowledge with others until the leading-edge practices become the norm at all utilities. Bringing about excellence in the execution of particular processes, procedures, techniques and tasks is above all a function of hard work, training, coaching, peer-to-peer exchange and mentoring.

At the federal level, the EPA has been an active collaborator and advocate for asset management. The EPA sponsors two-day "hands on" Advanced Asset Management Workshops. These sessions are undertaken in conjunction with local partner organizations. Over the last couple of years, 15 sessions have been held at various locations throughout the country. To date, about 1,600 have attended the workshops. Information regarding the Asset Management Training Workshop can be found online at the agency's Web site: *http://www.epa.gov/owm/assetmanage/assets_training.htm*.

In addition, recognizing a major need to explore ideas and seek common understandings about priorities, the EPA, in a partnership with the National Asset Management Steering Committee — held an Asset Management Collaborative Working Session in May. The working session brought together a broad cross-section of key stakeholders representing utilities, consultants, professional and industry associations, researchers and educators (over 140 participants from 12 countries). The session served as an opportunity to exchange information about the "state of the practice" of asset management in the United States and around the world. The single most prevalent theme that emerged was that of "knowledge transfer" — the effective and efficient accumulation, organization and dissemination of best practices regarding asset management relevant to the U.S. management culture. Details of the workshop can be found at: *http://www.epa.gov/owm/assetmanage/index.htm*.

Are There Asset Management Minimums?

Almost certainly! Although there may not be any particular currently accepted articulation of conventions used to distinguish the adequacy of practices, at a basic level, when accountabilities are confronted the inability to successfully demonstrate minimum activities and actions is tantamount to negligence. Some level of common sense about basic understandings concerning the community's water assets is at the center of carrying out any successful forward-looking strategy.

Recognize that confronting the infrastructure challenge head-on is fundamental to the public health, environmental quality and economic well being of every community. The ability to predict, manage and respond to failures is within what should be the essential set of required management skills. Highly competent management of the integration of the maintenance, repair, renewal and replacement cycle is critical to efficiently sustaining the system.

Expect that with or without further directives, within a five- to 10-year timeframe, advanced asset management practices will become the norm in the water sector. In the relatively near term, any community that owns and operates assets should have and be able to demonstrate:

1. A basic level of understanding about the assets they own, have some knowledge of their condition, be able to recognize what aspects of the system are most critical to meeting service objectives and have a responsible financial plan to manage the system's investment priorities.

2. An Asset Management Plan. This is a document that makes transparent to the community the choices that are being made with regard to the community's assets. The plan can be relatively simple and appropriate to the size and relative complexity of the system. The plan is the basis for rationalizing the capital and operating budgets. The absence of a plan is prima facie case that practices are less than adequate.

3. The capacity to bring appropriate practice to bear in managing failures. There should be an understanding of the risk and consequence of system failures. There must be an understanding of which failures are within norms and which failures are catastrophic. The priorities associated with failure management should be transparent to the community.

4. A vision of the financial measures leading to financial self-sufficiency.

The inability to the affirmatively complete the four tasks, outlined above, are a strong indication that the community has not demonstrated the capacity, capability or willingness to do the job at a minimally satisfactory level. The community is putting itself and its customers at a huge risk.

What Are the Characteristics of a Sustainable Service Provider?

Sustainable water businesses set service standards that are concerned with protecting and promoting the public health and ecological sustainability of the natural environment. They are responsible for obtaining the financial resources necessary to sustain the service levels. They manage their human and organizational resources and track performance against the goals. They utilize the tools and techniques of risk assessment and asset management to decide upon priority work and select least life-cycle cost ways to accomplish tasks and objectives. The better they become at integrating information and deploying management systems across these functions, the greater the opportunities they will have to identify the most effective and least costly pathways forward. They also use well developed system approaches (Ecologically Sustainable Development, Environmental Management Systems and Asset Management) to provide the wherewithal to integrate the critical aspects of strategically managing sustainable services.

The vision of helping move all utilities toward a sustainable future can be greatly informed by a strategic examination of service providers currently focused on this goal. When service providers have highly developed skills in the following areas, they tend to attain excellent environmental, social and economic outcomes. These are the features:

1. Setting objectives for economic, social and environmental measures. This is sometimes called managing against the triple bottom line.
2. Right sizing the organization to professionally manage its task. When capacity and capability are considered, it produces alternative institutional arrangements.
3. Incorporating stewardship for the total water cycle into management perspectives and practices. The organizations integrate management options from the point of view of water source acquisition, through treatment and distribution and collection and cleanup. Effective coordination across the total water cycle is highly valued in the decision processes.
4. Focusing on excellence in the mechanics of efficiency, customer service and quality decision-making. Employing commercial tactics in accomplishing the work and becoming skilled at customer service is essential. Having mature asset management skills highly correlates with the use of risk assessment tools and techniques to understand options and make priority decisions.
5. Maximizing the use of voluntary policies, procedures and practices that are externally audited. The external auditors become a critical part of the transparency-accountability equation in building public confidence in practices and use of data and information.

How Does Asset Management Relate to Sustainable Infrastructure?

Having a solid business basis for managing assets helps make America's infrastructure challenge more manageable. Nevertheless, adopting best practices in asset management is a first step in a broader set of "changes" that are likely to emerge over the next decade. By itself, asset management will not produce sustainable systems independent of broader public policy considerations. However, the shift toward an asset management based paradigm does much to inform a difficult set of choices about the future of the water sector. A significant transformation of the water sector is inevitable. What's involved must be better understood, before it can happen.

We have examples. What transpired in many other countries is likely to play out here in a uniquely American way. The experience was pretty much as follows: public agencies were unable to satisfy the rapidly expanding range of demands for water services. Challenges included the lack of public funds, the increased performance requirements, the large investment gaps and aging infrastructure in need of rehabilitation. The conditions sound familiar, don't they? Collectively, these challenges became insurmountable burdens.

You have probably heard general characterizations about the measures that followed. The typical changes were framed around competition policies and competitive neutrality between public and private owners, outsourcing models, organizational mergers, new approaches to overseeing and managing price regulation and the establishment of commercial objectives for water services. Service providers were expected to have the capacity to foster efficiencies, streamline work processes and modernize management controls.

The services tended to be integrated. Organizations were vertically joined to manage the whole water cycle, from the point of water source acquisition, through treatment and distribution and collection and cleanup. These integrated service providers were entrusted to bring a more comprehensive approach to management and a broader vision of the options to meet objectives. Also, the service providers were directed to price water for full cost recovery and to operate on the basis of commercial principles. Although most developed countries established subsidy arrangements, in the long-term their subsidy schemes tended to involve arrangements that were income-based, means tested and directed toward addressing concerns affordability. Affordability was defined as a problem to be addressed at the household level rather than the community level.

The Big Five Big Stumbling Blocks

The pathway to sustainable systems has many stumbling blocks. Below are the five of the biggest challenges faced by communities on the road to sustainability:

Intergovernmental Relationships — An environmental regulator and a service provider do not always have the same aims and sometimes they can be in conflict. The federal and state governments have little direct authority in day-to-day operations and funding decisions with respect to most local infrastructure. Those responsibilities fall instead to local governments. Nevertheless, under any scenario, the federal and state levels have substantial impact on local infrastructure through their statutory driven regulatory initiatives and requirements. The intergovernmental relationships have continued to evolve toward a format relying on an overly litigious structure to define priority work. In this context, it is easy for critical infrastructure decisions to come about in the wrong way and at the wrong time. In effect, it's the antonym of what the expert practitioner would say asset management is all about.

When significant infrastructure decisions are managed in the context of an adjudicatory process, the circumstances reflect a breakdown that has already occurred in the intergovernmental understanding of performance expectations. The potential to collaboratively solve problems is clouded by venue. Methods of collaboration, not confrontation, provide a much better forum for informing a sustainable pathway forward. The intergovernmental processes that drive key decisions must come about at an early point where the alternative visions of the watershed and its priorities are identified, alternative service levels and costs are presented and competing priorities are ranked.

Knowledgeable Valuation and Pricing — Most American households (at least 75 percent) can afford to pay the costs of services; assuming the service level is responsibly set and if the service providers pursue optimal strategies for delivering the service at least cost over the long-term. Ultimately, the citizens pay 100 percent of the costs of water and wastewater services, whether through ratepayers bills or through federal, state or local taxes. The fundamental principle that ought to be endorsed is that the portion of the population that can afford the full price of services should pay the full price for these services within the context of the rate structures. This is about applying commercial value to the services.

Restructure Institutional Arrangements — Creating the conditions for success demands changes in how the water sector is organized to do the work. According to commonly cited data, America has approximately 54,000 community water systems and 16,000 wastewater systems. Anecdotal information suggests the number of service providers continues to increase. The decentralized management and delivery of services represents one of the more decentralization service arrangements found in industrialized countries.

Organizations that are unable to set services levels to successfully protect and promote the public health and sustain the natural environment or are incapable of obtaining the financial resources to sustain the service levels, cannot be successful in sustaining quality services. Prior subsidy arrangements have been an institutional enabler. By the numbers, the majority of existing service providers cannot economically succeed absent subsidies.

The structural arrangements and subsidies present a catch-22 of sorts. If it wasn't for grants, loans and transfer programs, a significant portion of current service providers would not continue to exist as independent service providers. There is no reason to think that organizations that were unable achieve expected service levels without subsidies can be successful at sustaining current and possibly higher services levels absent the continuation of subsidies. If self-sustainable systems are the vision of the future, something akin to the private sector parallel of the economically driven mergers and acquisitions is called for. Obviously, deciding to move along these lines will be a hugely unpopular political decision. The idea can only be advanced through an incentive structure.

Recognize Affordability as a Driver — Governments have the responsibility to protect public health and the environment and to ensure that their citizens can meet basic water needs. Even in systems where full cost recovery principles are drivers of the user fees, the governments (federal, state or local) generally have approaches in place to ensure that water and wastewater services are accessible and affordable. Affordability of services has been the domain of local governments. If higher service levels are to be sustained, means testing needs to come to the forefront in the allocation of subsidy dollars. Affordability policies ought to relate to households, not whole communities. Subsidy arrangements, for the most part, have not been means tested to assure that the benefits were accrued by the households that actually had household income issues. Much better identification of the number and location of affected households is needed. Something akin to the energy policies for the economically disadvantaged provides a vision of a pathway that is in keeping with the integration of commercial objectives and addressing public access strategies.

Getting to the Right Place Involves Changes that Go Beyond the Service Providers — Bringing about a paradigm shift in water services cannot be solely a bottom-up phenomenon. The nation can progress along the lines of good innovations regarding asset management, but if the methods and approaches for setting service levels are in question, then it is possible to become extremely efficient about carrying out inefficient decisions. There appears to be disconnects between designated uses, reporting and permit writing, setting of enforcement priorities and negotiating consent degrees, which lead to prioritizing the wrong work. These disconnects need to be systematically worked through to bring clarity to service level decisions and make these decisions transparent.

Conclusions

Broad-based improvements in applied asset management practices provide for a huge step toward bringing about sustainable systems. Setting a basic agenda organized around the pursuit of sustainable services is a critical step. A collaborative understanding among federal, state and local governments of how water systems should be managed would improve the public's acceptance of what's really required. The pathway to sustainability is a quest that will last a generation or more. Progress starts with taking small steps in the right general direction.

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